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# PROGRAM IMPLEMENTATION PROCEDURES

## IMPLEMENTATION OF TWO YEAR POST HIGH SCHOOL WASTEWATER TECHNOLOGY INSTRUCTIONAL PROGRAMS

CLEMSON UNIVERSITY,
SOUTH CAROLINA

1973

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# Program Implementation Procedures

Implementation of Two Year Post High School Wastewater Technology Instructional Programs

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In the spring of 1970, Volume 1: Program Criteria, and Volume 2: Curriculum Guidelines, Criteria for Establishment of Two Year Post High School Wastewater Technology Programs, were completed and three two year post high school institutions were selected to implement the program. The institutions used these two volumes as guides and continued to develop lesson plans and instructional materials. With the experience gained by these institutions, it is now time to revise Volume 1 so that other institutions can benefit from the experience of this initial two year effort. The goal of this document is to assist other institutions in evaluating their own readiness and ability to conduct an instructional program for wastewater treatment plant technicians, and to suggest a system that they might follow in accomplishing this objective.

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TECHNOLOGY INSTRUCTIONAL PROGRAMS

ENVIRONMENTAL PROTECTION AGENCY

CLEMSON UNIVERSITY

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## PREFACE

In the spring of 1970, *Volume I: Program Criteria* and *Volume II: Curriculum Guidelines, Criteria for Establishment of Two Year Post High School Wastewater Technology Programs* were completed and three two year post high school institutions were selected to implement the program. These institutions were:

Charles County Community College
La Plata, Maryland

Greenville Technical Education Center
Greenville, South Carolina

Linn-Benton Community College
Albany, Oregon

These institutions have used these two volumes as guides and continued to develop lesson plans and instructional materials. With the experience gained by these institutions, it is now time to revise *Volume I: Program Criteria* so that other institutions can benefit from the experience of this initial two year effort. The goal of this document is to assist other institutions in evaluating their own readiness and ability to conduct an instructional program for wastewater treatment plant technicians, and to suggest a system that they might follow in accomplishing this objective.

## INTRODUCTION

Experience gained over the last two years indicates that with some modifications the *Criteria for Establishment of Two Year Post High School Wastewater Technology Programs*, which was originally designed as a federally funded concept, could be adapted for any two year post high school institution desirous of providing instruction for wastewater technicians.

This document summarizes the major attributes of an institution that wishes to have a program of this type and offers suggestions for administering such a program. In addition, a suggested two year curriculum is offered with course descriptions prepared in performance terms.

## SUGGESTIONS FOR SELF APPRAISAL

### Philosophy and Purpose

The institutions should be convinced of the desirability and effectiveness of two year programs. It should be alert to the need for such programs, in general, and for a wastewater technology instructional program, in particular. The institution should be oriented towards the use of specific behavioral objectives for developing and evaluating such programs.

Such an institutions may be either public or private, profit or nonprofit, but it should possess the following characteristics:

1. Place a clear emphasis on occupational preparation as one of its purposes;
2. Offer post-secondary instruction leading to an Associate degree;
3. Accept students who are not high school graduates into its instructional program; and
4. Offer remedial instruction, when needed, in basic education.

### Administrative and Institutional Support

The institution must exhibit a clear interest in a wastewater technology instructional program and be willing to provide administrative support for such a program. This must include adequate financial support. Funds must be budgeted for professional development of instructional staff, including opportunities for contact with other professionals at local, state, and national levels. The budget should include items for instructor's travel and participation in professional meetings on a scheduled basis. A reasonable minimum of such activities might include:

1. National meeting--annually;
2. Professional seminars--semi-annually;
3. Continuing education course(s)--annually;
4. Professional society (local) at the discretion of the instructor; and
5. Seminar or short course study of advances in instructional technology, including innovative teaching techniques--annually.

The institution should provide and maintain an active student personnel services department which will meet the following student needs:

1. Provide student counseling services;
2. Maintain student records;
3. Support and assist in organizing programs of student activities;
4. Furnish adequate health services;
5. Offer financial advice and assistance when needed;
6. Assist in locating student housing; and
7. Provide for student testing and evaluation.

The institution should provide adequate ancillary personnel to efficiently and effectively conduct noninstructional activities in support of the instructional program. This would include secretarial assistance and technicians to assist with laboratories (chemistry, biology, and equipment maintenance).

### Curriculum

Suggestions for curriculum are given on pages 18 to 19. During the initiation of the program, the administration should plan to reduce the work load for instructors to give them time to plan and organize the program.

Students should be permitted to learn, each at his own pace. This will mean that time requirements must be kept flexible, and adequate guidance and help should be provided for each student. The student should learn to take the major responsibility for planning and learning. At all times he should be a participant, and not merely a spectator, in the learning process. Most students do not have these skills when they enter the course. A conscious effort must be made by the instructors if these skills are to be developed.

Instructional modules should be sized and sequenced to provide the most effective learning environment that is possible. The student must have continuing feedback concerning his progress to facilitate his learning. Individualized instruction includes many types of learning activities which should be selected on the basis of their effectiveness in achieving learning.

### Instructional Staff

Instructors in the technical courses should have at least a B.S. degree and two full years full-time work experience. If such individuals are not available, those with at least six years full-time work experience in the field would be desirable. Another alternative might be to provide existing staff with background to qualify them for teaching the courses.

### Physical Facilities

1. Technical facilities are described in the section on wastewater treatment facilities (pages 10 to 17).

2. Adequate classroom, laboratory, storage, and noninstructional space must be available to accommodate the number of students, staff, and equipment to be housed in the area.

3. Plans should be made to expand the facilities if enrollment increases.

### Recruitment and Placement

The institution should institute a plan for recruiting students. This program should cover a wide geographic area. It should include communicating with secondary schools, with the general public, and with various commercial and civic organizations, especially those connected with the wastewater treatment field.

Recruiting brochures, pamphlets, and announcements must be factual and accurately stated and presented in a manner that will bring credibility to the program.

Potential students should be given an orientation tour of a wastewater treatment plant prior to enrollment. This is especially important.

Admissions policies should be flexible, allowing individuals to enter who have not graduated from high school if they can demonstrate the desire and the capability to succeed in the program.

Wastewater treatment plant employees should be encouraged to enroll if they are qualified. However, there should be adequate modification of their educational program in consideration of their prior knowledge and skill.

The institution should assist the student in finding a work situation which utilizes the student's training and special capabilities in the wastewater treatment field. The institution should provide assistance in arranging interviews with appropriate organizations in the wastewater treatment field.

There should be a follow-up of graduates after employment to assist and counsel them in achieving advancement and to provide feedback to the institution that may help to improve the instructional program.

**Public Relations**

An adequate public relations program is essential to the success of a wastewater technology instructional program. The PR program should develop close ties between the school and the community and develop support for the institution's goals. The PR program can provide information about potential applicants and the success of graduates. It can identify potential members of the institutional advisory board as well as promote local financial support for the institution.

## INSTITUTIONAL ADVISORY BOARD

The institution should utilize the services of an advisory board. The Regional Director of the EPA would be available to assist in establishing such a board. Such a board could assist in the following activities:

1. The recruitment of students for the program;
2. The selection of in-plant instruction sites;
3. The placement of students for in-plant instruction;
4. The placement of graduates upon completion of the program;
5. The upgrading of entrance job classification and pay scale for graduates;
6. The acceptance of the graduate by civil service systems, unions, and other employing and certifying organizations; and
7. The improvement of equipment and facilities at the educational institution.

The Institutional Advisory Board should be appointed by the officials of the institution in consultation with the director of the program, officials of regional business and industries related to wastewater treatment, and the regional director of the EPA. The latter should be included as a member of the board.

The Advisory Board might be composed of no fewer than seven members sufficiently representative of regional and local organizations as well as professional groups having concern for water quality and related occupations. The members may represent, but not be limited to, the following:

1. State official agencies governing the registration and qualifications of wastewater treatment employees;
2. State officials of water pollution control authority;
3. State civil service or merit systems;
4. Unions;
5. Personnel or education committees of water pollution control associations;
6. Water and wastewater equipment manufacturers and their associations;
7. Practicing wastewater treatment operators;
8. Municipal league;
9. Professional sanitary engineers (consultation and design);
10. Professional educators from other institutions;
11. Local manager of cooperating wastewater treatment plant; and
12. Industries having wastewater treatment facilities.

Each member should be appointed for a period of two or three years, in such a manner that not more than one half of the members will be replaced in a single year. Members should not be precluded from service with other organizations or committees. The institution should provide the necessary funding for the meetings of the board.

Meetings should be called by the chairman not less than once each half-year. The chairman will be responsible to guide board activities for the benefit of the institutional program. Also, the board should assist the institution to conduct a self-evaluation of the program and to prepare a written report that reflects how the institution has met the various criteria that have been set.

## STUDENT CHARACTERISTICS

There are few, if any, objectively qualified measures of student characteristics that might be useful in selecting students for the program. The educational institution should develop and use objective measures in the student recruitment and selection process whenever it is possible. Because of the great variety in background and experience of potential students, a great deal of flexibility must be permitted in selecting students. The present document will offer only general guidance in student selection. Applicants may be classified into one of four general categories: high school graduates with work experience, high school graduates without work experience, nongraduates with work experience, and nongraduates without work experience.

Applicants in each of these groups must be given special consideration in selecting them for admission as well as in planning their instruction. Each applicant should be screened on the basis of the following characteristics:

1. *Evidence of academic ability:* There should be adequate evidence, either from school reports, entry tests, or in-depth interviews, that the student is able and interested in a career in wastewater technology.
2. *Aptitudes:* Information on aptitudes might be obtained from simple performance tests, giving particular attention to motor coordination, ability to use tools, reasonable visual and auditory acuity, and the ability to identify such odors as $H_2S$, chlorine, and other odors commonly found in treatment plants.
3. *Interests:* A student should be interested in maintaining the quality of his environment, in applied science, particularly as it relates to wastewater treatment operations and in public service that frequently involves less prestige and influence.
4. *Temperament:* The student should be able to get along well with others, both as a supervisor and as a subordinate. He should be responsible in the face of political, regulatory, and public scrutiny and criticism. He must maintain quality performance in highly repetitive, routine procedures. And he must be willing to accept the responsibility for the safety and welfare of himself, his fellow workers, and the general public.
5. *Physical capability and sensitivity:* The student should be able to perform the necessary tasks related to wastewater treatment plant operation. He must be able and willing to work in closed places for long periods of time and to spend much of his time either indoors or outdoors, depending upon the type of plant in which he will work. He must be able to work in wide ranges of temperature and in unpleasant surroundings. He cannot have allergies or personal dislikes that might prevent him from working in areas where dust, odors, fumes, and toxic odors might be present.

In the course of interviewing and testing applicants, it will sometimes become obvious that the applicant is capable of a much higher level of education and work than that offered by the wastewater treatment program. In such cases, the applicant (or student) should be counselled and provided assistance, if he wishes it, to find opportunities that better suit his qualifications.

**Characteristics of Graduates**

The graduate of a two-year post high school wastewater technology instructional program will have hands-on skill and knowledge with respect to specific functional procedures and process units representative of those in wastewater treatment plants. He will be able, with confidence and relative ease, to adapt the specific skill and knowledge he has acquired through the instructional program to other plants and processes not taught directly in the program. General statements of the skill and knowledge he has acquired may be found in the Lesson Plan Cover Sheets in the section on Course Descriptions (pages 21 to 37).

**Types of Positions**

Graduates should be regarded as technicians and paraprofessionals. This implies competence involving hands-on levels of application in performing most of the basic procedures in the overall operation of the plant. During his first weeks on the job, the graduate will require varying degrees of supervision in the performance of his tasks. He will require more supervision in performing Management/Supervisory and Systems Interaction procedures. (For a description of these activities, see the Glossary, pages 41 to 42).

In most cases, the program graduate should enter employment as an "intern" preparing for rapid advancement to one of three positions. In some cases, the entry position may be that of sole employee. The actual position will depend on the plant size; for example:

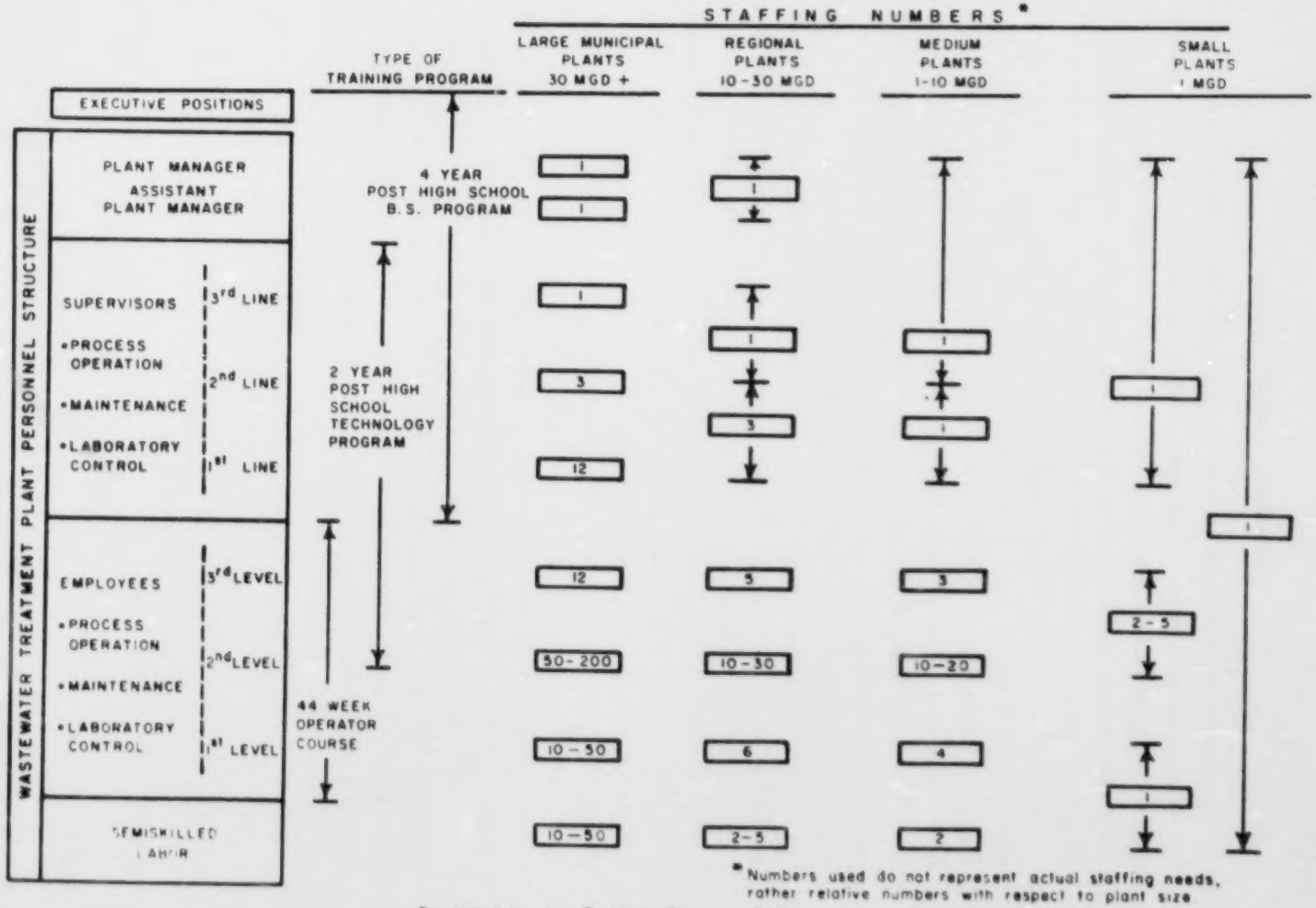
| Plant Size | Position |
|---|---|
| Less than 1 MGD | Plant Manager |
| Up to 10 MGD | Plant Manager Internship |
| Up to 30 MGD | Assistant Plant Manager Internship |
| More than 30 MGD | Shift or Process Supervisor Internship |

There is nothing inherent in the proposed curriculum that will selectively prepare a student for any one of the above positions. Basic personality, personal ambition, geographic preferences, and job availability are factors that will continue to exercise significant influences in the choices and chances of the program graduate.

Although the program graduate may, at the outset of his employment, perform the most basic tasks and serve brief periods in a variety of jobs and at various levels of responsibility, his terms of employment and job title should clearly indicate his internship. Remuneration, advancement, and other employment advantages should reflect the special skill and knowledge acquired during his educational program.

The chart on the next page shows the relationship of the subject training program to other training programs at a higher and lower level of skill and knowledge in the wastewater treatment field. The placement of most of the program graduates is indicated and the expected overlaps graphically presented.

## RELATIONSHIP OF PLANT SIZE TO TRAINING PROGRAM AND TO STAFF LEVEL AND NUMBER




* Numbers used do not represent actual staffing needs, rather relative numbers with respect to plant size

Developed by Joe Bahnick, Division of Manpower and Training, WQO, EPA

## WASTEWATER TREATMENT FACILITIES

The development of the requisite skills for operating, maintaining, and managing wastewater treatment facilities is the ultimate aim of this curriculum. Thus, it is necessary for the institution implementing this curriculum to have available the necessary process units so the student can obtain the hands-on skills he will need. More than likely, it will not be possible to find one facility with all the necessary process units; thus, several facilities may be used in the program.

To assist the institution in determining whether or not the available wastewater facilities are acceptable, a description of the process units to be studied is given. A facility with these units is termed a *Composite Model Plant* (CMP) and is one of the essential points of reference in this curriculum. The CMP in reality represents many wastewater treatment plants in one model. The process units included in the CMP are shown in the PROCESS CHART on page 11. In this chart a letter of the alphabet identifies each treatment process included in the CMP. The CMP does not represent an actual plant, but is a composite plant that includes process units found in many plants. Such a composite, or mix, of processes would seldom, if ever, occur. However, if a student were to acquire competency in the operation and management of such a plant, there is high probability of his successfully transferring his competency to almost every plant currently in operation. The CMP provides a point of reference in deciding what specific skill and knowledge a student should acquire in order to have a practical and generalizable competence.

A list of suggested units has been included in this section to assist an institution in selecting adequate instructional process units in the program. This listing suggests the major features of the process unit arranged in descending order of recommended suitability. An institution should seek process units as near to the top of the list as possible for use as hands-on instructional sequences.

Table I summarizes the process units recommended for each of the CMP units. In this table, the PRINCIPAL process units are designated by the number 10, and the OTHER units are given higher numbers.

The CMP plant is one composed of the PRINCIPAL process units, and these should be emphasized in the instruction. When it is not possible to utilize plants with PRINCIPAL units for instruction, special effort should be given to informing students of the operation and function of the PRINCIPAL units. On the other hand, students should be familiar with the OTHER units because they may encounter them in the plants in which they study and work.

# PROCESS CHART

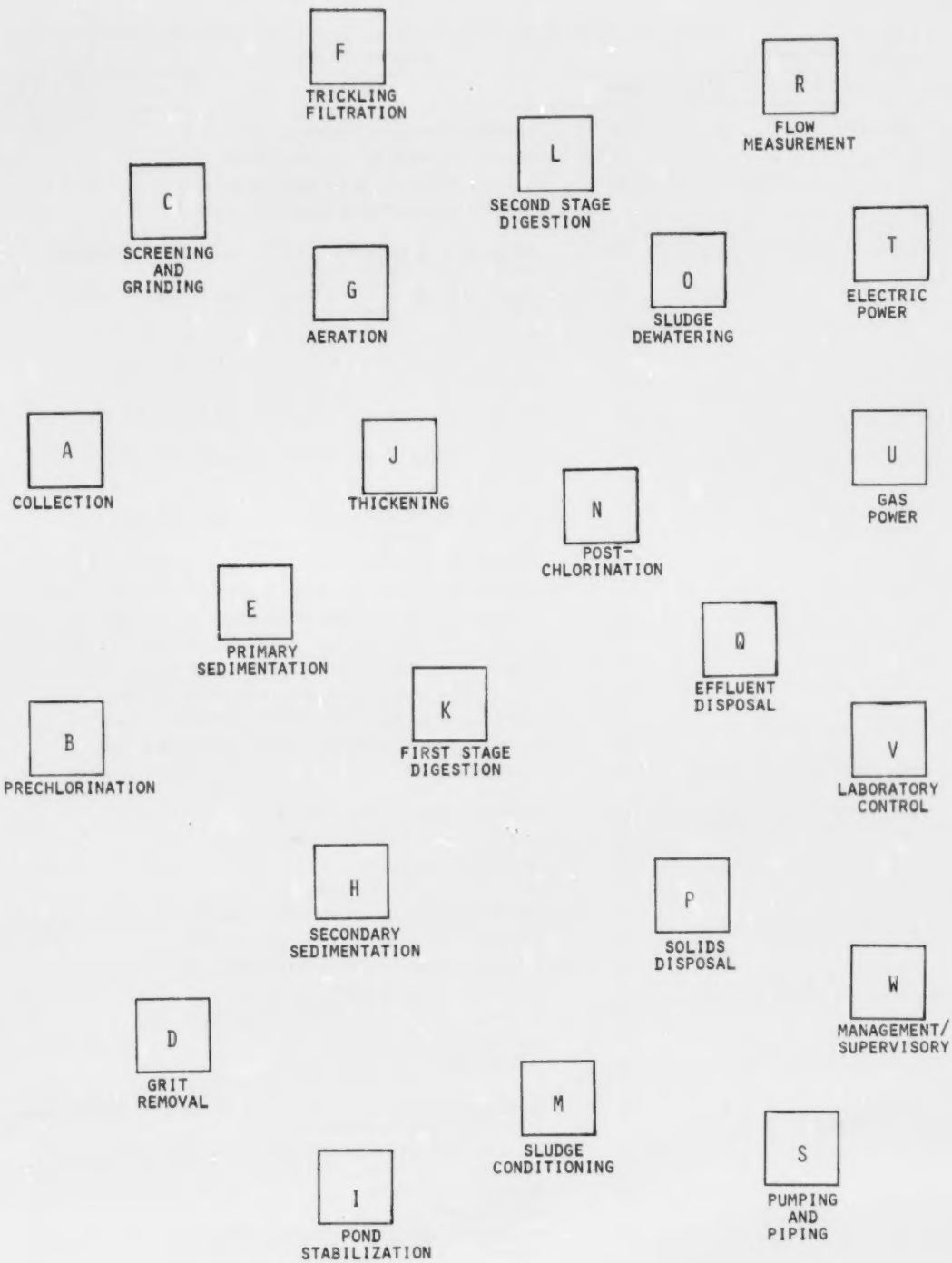


TABLE I

SPECIFIC PROCESS UNITS RECOMMENDED FOR USE IN IMPLEMENTATION OF THE TWO YEAR POST HIGH SCHOOL WASTEWATER TECHNOLOGY INSTRUCTIONAL PROGRAM

| CMP UNIT | | SPECIFIC PROCESS UNIT | |
|---|---|---|---|
| Name | Code Letter | Number | Description |
| Collection | A | 10 | Combined system with industrial waste |
| | | 20 | Sanitary system with industrial waste |
| | | 30 | Combined system without industrial waste |
| | | 31 | Sanitary system without industrial waste |
| Prechlorination | B | 10 | Vacuum chlorinator with automatic feed to pipe, pneumatic control, and electric evaporator |
| | | 20 | Vacuum chlorinator with automatic feed to pipe, electrical control, and electric evaporator |
| | | 30 | Solution feed chlorinator with discharge to pipe |
| | | 31 | Solution feed chlorinator with discharge to channel |
| | | 32 | Solution feed chlorinator with discharge to basin |
| | | 33 | Vacuum chlorinator with electrical evaporator and discharge to channel |
| | | 34 | Vacuum chlorinator with electrical evaporator and discharge to basin |
| Screening and Grinding | C | 10 | Mechanically cleaned bubbler control unit with grinder |
| | | 20 | Mechanically cleaned electrode control unit with grinder |
| | | 30 | Mechanically cleaned timer control unit without grinder |
| | | 31 | Mechanically cleaned electrode control unit without grinder |
| | | 32 | Mechanically cleaned float control unit without grinder |
| | | 33 | Mechanically cleaned manual control unit without grinder |
| | | 34 | Mechanically cleaned bubbler control unit without grinder |
| | | 35 | Mechanically cleaned time control unit with grinder |
| | | 36 | Mechanically cleaned float control unit with grinder |
| | | 37 | Mechanically cleaned manual control unit with grinder |
| | | 38 | Comminution unit |
| Grit Removal | D | 10 | Aerated unit with bucket elevator |
| | | 20 | Aerated unit with screw conveyor |
| | | 30 | Aerated unit with air lift |
| | | 31 | Aerated unit with clam shovel |
| | | 32 | Velocity control unit with screw conveyor |
| | | 33 | Velocity control unit with bucket elevator |
| | | 34 | Velocity control unit with clam shovel |
| | | 35 | Surface overflow unit with screw conveyor |
| | | 36 | Surface overflow unit with bucket elevator |
| | | 37 | Surface overflow unit with rake |
| | | 38 | Cyclone unit |
| Primary Sedimentation | E | 10 | Rectangular unit with telescopic valve draw off, density meter time clock, and trough with scraper |
| | | 20 | Circular unit with telescopic valve draw off, density meter time clock, and trough with scraper |
| | | 30 | Rectangular unit with sight glass, direct draw off, and trough with scraper |
| | | 31 | Rectangular unit with sight glass, direct draw off, and helical skimmer |

TABLE I
(continued)

| CMP UNIT | | SPECIFIC PROCESS UNIT | |
|---|---|---|---|
| Name | Code Letter | Number | Description |
| Primary Sedimentation (continued) | E | 32 | Circular unit with sight glass, trough with scraper, and direct sludge draw off |
| | | 33 | Circular unit with sight glass, trough with scraper, and telescopic valve draw off |
| | | 34 | Rectangular unit with helical skimmer and density meter time clock |
| | | 35 | Rectangular unit with helical skimmer and telescopic valve draw off |
| Trickling Filtration | F | 10 | Rotary distributor, standard rate unit with dosing tank |
| | | 20 | Rotary distributor, high rate unit |
| | | 30 | Rotary distributor, roughing unit |
| Aeration | G | 10 | Diffused air unit with swing type diffuser producing fine bubbles |
| | | 20 | Mechanical aeration unit with turbine and sparger |
| | | 30 | Diffused air unit with fixed type diffuser producing fine bubbles |
| | | 31 | Diffused air unit with swing type diffuser producing large bubbles |
| | | 32 | Diffused air unit with fixed type diffuser producing large bubbles |
| | | 33 | Flat plate diffuser |
| | | 34 | Mechanical aeration unit with brush |
| | | 35 | Mechanical aeration unit with propeller |
| | | 36 | Ejector nozzle aeration unit |
| | | 37 | Ejector aeration unit |
| Secondary Sedimentation | H | 10 | Circular, peripheral feed unit with suction |
| | | 20 | Circular, center feed unit with suction |
| | | 30 | Rectangular unit |
| | | 31 | Circular, center feed unit with scraper |
| | | 32 | Circular, peripheral feed unit with scraper |
| Pond Stabilization | I | 10 | Aerobic pond |
| | | 20 | Facultative pond |
| | | 30 | Anaerobic pond |
| Thickening | J | 10 | Floatation unit with air |
| | | 20 | Floatation unit with vacuum |
| | | 30 | Stirring and settling unit |
| | | 31 | Centrifuge unit |
| First Stage Digestion | K | 10 | Fixed cover, gas recirculation unit with external heat exchanger |
| | | 20 | Floating cover, gas recirculation unit with external heat exchanger |
| | | 30 | Aerobic digester unit |
| | | 31 | Fixed cover unit with turbo mix |
| | | 32 | Fixed cover unit with hot water coil heat |

TABLE I
(continued)

| CMP UNIT | | SPECIFIC PROCESS UNIT | |
|---|---|---|---|
| Name | Code Letter | Number | Description |
| Second Stage Digestion | L | 10 | Floating cover unit with gas storage |
| | | 20 | Fixed cover unit |
| | | 30 | Aerobic digester unit |
| Sludge Conditioning | M | 10 | Chemical conditioning unit with counter-current elutriation |
| | | 30 | Multi-stage elutriation unit |
| | | 31 | Single stage elutriation unit |
| Postchlorination | N | 10 | Vacuum chlorinator with automatic feed to pipe and close loop pneumatic control |
| | | 20 | Vacuum chlorinator with automatic feed to pipe and close electrical control |
| | | 30 | Solution feed chlorinator with discharge to pipe |
| | | 31 | Solution feed chlorinator with discharge to channel |
| | | 32 | Solution feed chlorinator with discharge to basin |
| | | 33 | Vacuum chlorinator with discharge to channel |
| | | 34 | Vacuum chlorinator with discharge to basin |
| Sludge Dewatering | O | 10 | Vacuum filter unit with cloth |
| | | 11 | Continuous feed centrifuge |
| | | 20 | Vacuum filter unit with coil |
| Solids Disposal | P | 10 | Multiple hearth incinerator unit |
| | | 20 | Fluidized bed incinerator unit |
| Effluent Disposal | Q | 10 | Direct reuse system |
| | | 20 | Underground disposal system |
| | | 30 | Dilution system |
| | | 31 | Irrigation system |
| | | 32 | Intermittent sand filter unit as used in tertiary treatment |
| Flow Measurement | R | 10 | Centralized recording and totalizing system including Parshall flume, Venturi meter, magnetic flow meter, and rotameter |
| | | 30 | V notch weir unit |
| | | 31 | Rectangular weir unit |
| | | 32 | Proportional flow weir unit |
| | | 33 | Kennison nozzle unit |
| Pumping and Piping | S | 10 | System with magnetically connected, pneumatically controlled, diesel driven, centrifugal pumps; speed reducer connected, electrically controlled, motor driven, positive displacement pumps; and the piping appropriate thereto |
| | | 30 | System with magnetically connected, pneumatically controlled, diesel driven, air lift pump; speed reducer connected, electrically controlled, motor driven, positive displacement pumps; and the piping appropriate thereto |
| | | 31 | System with magnetically connected, pneumatically controlled, diesel driven, screw lift pump; speed reducer connected, electrically controlled, motor driven, positive displacement pumps; and the piping appropriate thereto |
| | | 32 | System with magnetically connected, pneumatically controlled, diesel driven, hand driven pump; speed reducer connected, electrically controlled, motor driven, positive displacement pumps; and the piping appropriate thereto |

TABLE I
(continued)

| CMP UNIT | | SPECIFIC PROCESS UNIT | |
|---|---|---|---|
| Name | Code Letter | Number | Description |
| Pumping and Piping (continued) | S | 33 | System with magnetically connected, pneumatically controlled, diesel driven, water driven pump; speed reducer connected, electrically controlled, motor driven, positive displacement pumps; and the piping appropriate thereto |
| | | 34 | System with magnetically connected, pneumatically controlled, diesel driven, air driven pump; speed reducer connected, electrically controlled motor driven, positive displacement pumps; and the piping appropriate thereto |
| | | 35 | System with magnetically connected, pneumatically controlled, diesel driven, pneumatic ejector pump electrode controlled; speed reducer connected, electrically controlled, motor driven, positive displacement pumps; and the piping appropriate thereto |
| Electric Power | T | 10 | System using delta transformers, generators, electrical switch gear, automatic gear, automatic circuit actuators on motors, and telemetering with alarms |
| | | 20 | System using Y transformers, generators, electrical switch gear, automatic circuit actuators on motors, and telemetering with alarms |
| | | 30 | System with internally produced gas with gas holder covers and centrifugal blowers |
| Gas Power | U | 10 | System with internally produced gas with high pressure tanks and rotary positive displacement compressors |
| | | 20 | System with internally produced gas with high pressure tanks and reciprocating compressors |
| | | 30 | System with internally produced gas with gas holder covers and centrifugal blowers |
| Laboratory Control | V | | The trainee will have access during training to a model laboratory facility, typical of a 5 mgd to 25 mgd plant, consisting of the following types of furnishings, equipment, and supplies . . . |
| | | 10 | Furnishings<br>a. cupboard units<br>b. sink cupboard unit with mixing faucet, polyethylene sink trap and stand pipe<br>c. gray colorlith tap and splashback for entire assembly with gas key hose cock and 2 electric outlet boxes<br>d. storage unit lockable with adjustable shelves<br>e. fume-hood with motor and blower<br>f. desk, chairs, and stools<br>g. calculator<br>h. typewriter<br>i. filing cabinet |
| | | 11 | Equipment<br>a. clock, interval timer<br>b. de-ionizer<br>c. refrigerator, at least 10 $ft^3$<br>d. BOD incubator<br>e. water still<br>f. pH meter<br>g. balance, triple beam<br>h. balance, analytical<br>i. desiccator<br>j. drying oven<br>k. muffle furnace<br>l. pressure vacuum pump<br>m. bunsen burner<br>n. hot plate<br>o. water bath<br>p. colorimeter-spectrophotometer<br>q. digestion apparatus, Kjeldahl<br>r. distillation apparatus, Kjeldahl<br>s. gas analysis apparatus ($CO_2$)<br>t. sewage sampler<br>u. chlorine colorimetric equipment<br>v. condenser<br>w. microscope and light<br>x. sterilizer for sample bottles<br>y. incubator 37°C water bath<br>z. reflux assembly (COD)<br>aa. membrane filter apparatus (coliform)<br>bb. dissolved oxygen meter |

TABLE I
(continued)

| CMP UNIT | | | SPECIFIC PROCESS UNIT |
|---|---|---|---|
| Name | Code Letter | Number | Description |
| Laboratory Control (continued) | V | 12 | Supplies<br>a. general<br>(1) apron<br>(2) brushes<br>(3) funnels<br>(4) spatula<br>(5) wax pencils<br>(6) lubricants<br>(7) glassware cleaner<br>(8) face shield<br>(9) neoprene gloves<br>(10) graph paper<br>b. analytical<br>(1) sample bottles<br>(2) BOD bottles<br>(3) wash bottles<br>(4) dropping bottles<br>(5) test tube<br>(6) nessler tube<br>(7) Erlenmeyer flask<br>(8) volumetric flask<br>(9) filtering flask<br>(10) Kjeldahl flask<br>(11) round bottom flask<br>(12) separatory funnel<br>(13) Buchner funnel<br>(14) funnel support<br>(15) buret and buret caps<br>(16) buret clamp<br>(17) buret support<br>(18) Gooch crucible<br>(19) crucible holder<br>(20) crucible tongs<br>(21) pipets<br>(22) safety pipet filler<br>23) beakers<br>(24) graduated cylinders<br>(25) evaporating dish and petri/dishes<br>(26) opal glass plate<br>(27) glass fibre filter disc<br>(28) glass beads<br>(29) rubber stoppers<br>(30) rubber tubing<br>(31) utility clamps<br>(32) tripod<br>(33) filter paper<br>(34) thermometer<br>(35) media for bacteriological analysis<br>c. chemical<br>(1) methylene blue solution<br>(2) buffer solution<br>(3) phenolphthalein indicator solution<br>(4) thymol blue indicator solution<br>(5) methyl orange indicator solution<br>(6) manganous sulfate solution<br>(7) sodium thiosulfate solution<br>(8) starch solution<br>(9) calcium chloride solution<br>(10) ferric chloride solution<br>(11) magnesium sulfate solution<br>(12) phosphate buffer<br>(13) ferrous ammonium sulfate solution<br>(14) potassium dichromate solution<br>(15) sulfuric acid-silver sulfate solution<br>(16) ammonium chloride solution<br>(17) nessler reagent solution<br>(18) Rochelle salt solution<br>(19) zinc sulfate solution<br>(20) sodium arsenite solution<br>(21) standard nitrate solution<br>(22) boric acid solution<br>(23) sodium hydroxide-sodium thiosulfate solution<br>(24) sulfuric acid-mercuric sulfate potassium sulfate solution<br>(25) N-Butanol reagent<br>(26) chloroform reagent<br>(27) alkaline iodide azide reagent<br>(28) potassium iodide reagent<br>(29) arsenite reagent<br>(30) sodium sulfate reagent<br>(31) brucine-sulfanilic acid reagent<br>(32) mercuric sulfate reagent<br>(33) sodium hydroxide<br>(34) calcium chloride<br>(35) silicic acid<br>(36) sulfuric acid<br>(37) ferrion<br>(38) potassium chromate<br>(39) silver nitrate<br>(40) zonite |
| Management/ Supervisory | W | | The trainee will have access during training to a model office of a typical 5 mgd to 25 mgd facility, requiring the services of, and serving the purpose of, a superintendent, assistant superintendent, three foremen, and a secretary. The office will, in design and appointment, be representative of a typical plant office consisting of the following types of furnishings, equipment, and supplies . . . |

TABLE I
(continued)

| CMP UNIT | | SPECIFIC PROCESS UNIT | |
|---|---|---|---|
| Name | Code Letter | Number | Description |
| Management/ Supervisory (continued) | W | 10 | Furnishings<br>a. desks<br>b. chairs<br>c. file cabinets containing shop drawings, daily, monthly, annual reports, bid sheets, memos, inventory, personnel records<br>d. blue-print cabinet (with sample prints) and table<br>e. bookcase containing supply catalogs, reference materials, and technical journals |
| | | 11 | Equipment<br>a. typewriter<br>b. calculator<br>c. copy machine<br>d. duplicating machine<br>e. dictation equipment |
| | | 12 | Supplies<br>a. standard (as found in any office)<br>b. special (serving needs of wastewater plant--e.g., forms, log books, slide rule, etc.) |

## CURRICULUM OUTLINE

The Curriculum Outline consists of the recommended courses (Table II) with suggested quarter-hours credit and the time needed for study, together with a series of Lesson Plan Cover Sheets for each of the courses. The sheets will list the general goals of the course in behavioral terms.

### Using the Outline

The types of learning activities that are to be employed are important factors in planning courses to achieve the stated goals. Four types of learning activities are involved: classroom activities, laboratory activities, in-plant activities, and individual study activities.

In planning classroom activities, group discussion and interaction should be emphasized. A wide variety of teaching aids, including films, filmstrips, slides, tapes, overhead transparencies, and photographs should be used. It has been said that lectures are the most inefficient method of communication, and their use should be minimized.

Laboratory activities will involve the use of total process unit simulation as well as demonstration and discussion. Emphasis should be given to placing students in problem solving situations where they will learn to make decisions and find answers to questions. *Cookbook* laboratory work should be minimized and replaced by problems that are real to the students.

In-plant activities should be carefully planned and implemented. The plant manager should be involved in these plans which should move from developing familiarity with the plant and its operation to hands-on operation for specific tasks. Such procedures will prepare the plant manager and the students for the summer in-plant practicum and make it more effective and educational for the student.

Field trips are of special importance in the Introduction to Environmental Technology course. These trips should be carefully planned in advance. However, they should be open-ended enough to encourage the student to learn to make careful, independent observations and to remember what he has seen. Although field trips should emphasize both domestic and industrial wastewater treatment plants and their problems related to collection and treatment of wastewater, other factors in the environment should not be neglected. The student needs to understand the interrelationships of his work with other environmental problems.

Individual study activities should be varied. Short learning modules are far more effective than reading assignments. Although learning modules take time and effort to prepare, once available they may be reused many times. With a little encouragement, students can learn to make learning modules that are nearly professional in quality. Emphasis on aural and visual reinforcement will add to student interest and result in greater learning. The student should be guided from directed and carefully programmed study to independently planned study. Unless he can learn to "study on his own," the value of his education will soon be lost.

Both formal and informal learning situations should be evaluated. Frequent feedback should be provided the student to assist him in making further plans and in improving his study skills. This is most important in planning an effective learning program.

### Suggested Courses of Study

These suggestions may provide the basis for developing your own course of study. Titles and data correspond to that found on the Lesson Plan Cover Sheets that follow.

TABLE II

RECOMMENDED COURSES BY QUARTERS

| QUARTER | TITLE | CR[1] | C[2] | L[3] | SS[4] | P[5] | TOT[6] |
|---|---|---|---|---|---|---|---|
| 1st | Introduction to Environmental Technology (1-IET) | 6 | 5 | 3 | 10 | 0 | 18 |
| | Basic Biology (1-BB) | 4 | 3 | 3 | 6 | 0 | 12 |
| | Basic Math (1-BM) | 3 | 3 | 0 | 6 | 0 | 9 |
| | Communication Skills (1-CS-I) | 3 | 3 | 0 | 6 | 0 | 9 |
| | Personal Health (1-PH) | 2 | 2 | 0 | 4 | 0 | 6 |
| | SUBTOTAL | 18 | | | | | 54 |
| 2nd | Plant Operations I (2-PO-I) | 8 | 5 | 6 | 10 | 3 | 24 |
| | Basic Chemistry (2-BC) | 4 | 3 | 3 | 6 | 0 | 12 |
| | Communication Skills II (2-CS-II) | 3 | 3 | 0 | 6 | 0 | 9 |
| | Elective (2-E) | 2 | 2 | 0 | 4 | 0 | 6 |
| | Physical Education I (2-PE-I) | 1 | 1 | 0 | 2 | 0 | 3 |
| | SUBTOTAL | 18 | | | | | 54 |
| 3rd | Plant Operations II (3-PO-II) | 8 | 5 | 6 | 10 | 3 | 24 |
| | Laboratory Control I (3-LC-I) | 7 | 4 | 9 | 6 | 0 | 19 |
| | Technical Report Writing (3-TW) | 2 | 2 | 0 | 4 | 0 | 6 |
| | Physical Education II (3-PE-II) | 1 | 1 | 0 | 2 | 0 | 3 |
| | SUBTOTAL | 18 | | | | | 52 |
| 4th | In-Plant Practicum I (4-IPP-I) | 16 | 4 | 0 | 8 | 36 | 48 |
| 5th | Plant Operations III (5-PO-III) | 6 | 3 | 6 | 6 | 3 | 18 |
| | Plant Operations IV (5-PO-IV) | 4 | 3 | 3 | 6 | 0 | 12 |
| | Laboratory Control II (5-LC-II) | 7 | 3 | 12 | 4 | 0 | 19 |
| | Applied Math (5-AM) | 3 | 3 | 0 | 6 | 0 | 9 |
| | SUBTOTAL | 20 | | | | | 58 |
| 6th | Purchasing and Reporting (6-PAR) | 3 | 2 | 3 | 6 | 0 | 11 |
| | Process Interaction (6-PI) | 4 | 3 | 3 | 6 | 0 | 12 |
| | Laboratory Control III (6-LC-III) | 6 | 3 | 9 | 4 | 0 | 16 |
| | Applied Economics and Politics (6-EP) | 3 | 3 | 0 | 6 | 0 | 9 |
| | Elective (6-E) | 2 | 2 | 0 | 4 | 0 | 6 |
| | SUBTOTAL | 18 | | | | | 54 |
| 7th | Personnel Practices, Public Relations, and Planning (7-PP) | 3 | 2 | 3 | 6 | 0 | 11 |
| | Advanced Waste Treatment (7-AWT) | 8 | 5 | 3 | 12 | 9 | 29 |
| | Applied Psychology and Human Relations (7-APHR) | 3 | 3 | 0 | 6 | 0 | 9 |
| | Physical Education III (7-PE-III) | 1 | 1 | 0 | 2 | 0 | 3 |
| | SUBTOTAL | 15 | | | | | 52 |
| | TWO-YEAR TOTAL | 123 | | | | | |

[1]Quarter hours of credit

[2]Number of class hours recommended

[3]Number of laboratory hours

[4]Number of self-study hours

[5]Hours spent in plants

[6]Total hours of work required

# COURSE DESCRIPTIONS

## Lesson Plan Cover Sheets

These sheets describe the recommended courses with goals expressed in behavioral terms. Further information may be found in *Volume II* of the *Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Technology Training P grams*, published by the Environmental Protection Agency.

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*COURSE CODE:* 1-IET *QUARTER:* First

*COURSE NAME:* INTRODUCTION TO ENVIRONMENTAL TECHNOLOGY

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 6 | 5 | 3 | 10 | 0 |

*COURSE DESCRIPTION:* Upon completion of the course, the student will be able to do the following:

1. When questioned, can explain in terms understandable by the lay public how man is a user and not a consumer of resources and the importance of keeping resources in a reusable form.
2. Upon questioning, describe in terms understandable by the layman how man affects his environment, including types of solid, liquid, and gaseous wastes, eutrophication of streams and bodies of water, the role of energy as a nonrenewable resource, the importance of sanitation in the prevention of disease, and wastewater collection and treatment.
3. Given the description of a particular waste source, describe in terms understandable to the lay public the characteristics of the waste that has a detrimental effect on man and his environment.
4. Given the name or other description of a waste disposal practice, describe in terms understandable to the lay public how the practice may be detrimental or helpful to the use of the environment.
5. When asked, describe in terms understandable to the lay public the methods that may be used in a community to protect its environment and the relationships among the various methods.
6. When an example of improper waste disposal is described or shown, identify the improper practice and describe related historical events that illustrate disease, death, and environmental degradation attributed to improper waste disposal.
7. When asked, name the most common processes in wastewater treatment plants (see CMP) and describe in terms understandable to the lay public the function of each process.
8. Identify from photographs or an on-site visit the various units of a wastewater treatment plant.

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*COURSE CODE:* 1-BM *QUARTER:* First

*COURSE NAME:* BASIC MATH

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 3 | 3 | 0 | 6 | 0 |

*COURSE DESCRIPTION:* With respect to the CMP process, this course will enable the student to do the following:

1. When given data in tabular form, select specific data for use in solving math problems.
2. When given untabulated data and its probable use, construct tables that appropriately present data.
3. When given graphs constructed on arithmetic, semi-log, arithmetic probability, or log probability paper, use information from graphs to solve math problems.
4. When given basic data and its probable use, select and construct, as appropriate, arithmetic, semi-log, arithmetic probability, or log probability graph.
5. When given nomographs, use information from nomograph to solve math problems.
6. When given a math problem involving exponents, linear equations, algebraic equations or ratios and proportions, solve.
7. When given a math problem involving multiplication, division, and exponents, solve using a slide rule and/or a calculator.

*COURSE CODE:* 1-PH *QUARTER:* First

*COURSE NAME:* PERSONAL HEALTH

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 2 | 2 | 0 | 4 | 0 |

*COURSE DESCRIPTION:* With respect to the CMP processes, this course will enable the student to do the following:

1. When given a random list of common diseases, classify them according to the means of their transmission.
2. When given the task of moving a heavy object by rolling, lifting, etc., demonstrate the method that would minimize the possibility of personal injury.
3. When given actual indications, or a description of such indications, recognize as requiring certain safety equipment or tools, and demonstrate the use of the appropriate equipment.
4. When confronted with actual indications, or a simulation of conditions, recognize as requiring first aid and demonstrate the use of appropriate procedure(s).
5. When given the description of a toxic or otherwise dangerous material or condition, describe the method for perceiving this danger and the method of protecting himself and others.

*COURSE CODE:* 2-PO-I *QUARTER:* Second

*COURSE NAME:* PLANT OPERATIONS I

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 8 | 5 | 6 | 10 | 3 |

*COURSE DESCRIPTION:* With respect to CMP processes A, B, C, D, I, H, J, N, R, S, T, U, this course will enable the student to do the following:

1. When shown an actual process unit, or given a suitable description of one, describe the normal operation procedure to follow, including the frequencies involved, the conditions to look for, the actions to take, and for certain aspects, the operational "whys" that are most relevant.
2. When shown indications of abnormal situations, or given an appropriate description of them, recognize them as such and describe probable cause(s).
3. When shown a process unit, or given a description of one, describe references and tools available and use them to describe preventive maintenance procedures to follow, including the frequencies involved, the conditions to look for, the actions to take, and for certain aspects, the operational "whys" that are most relevant.
4. When shown actual indications of mechanical malfunctions, or given a description of them, recognize them as such, describe the immediate operational adjustments that may be necessary, and describe the references and tools available for use in correcting the malfunction.
5. When given a specific procedure drawn from those covered in this course, describe those aspects of the procedure related directly to employee safety, including how they protect the employee.
6. Given the common name of a process unit or unit component designated OTHER in the CMP, name the CMP PRINCIPAL process unit or unit component to which the OTHER term relates.

*COURSE CODE:* 3-PO-II *QUARTER:* Third

*COURSE NAME:* PLANT OPERATIONS II

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 8 | 5 | 6 | 10 | 3 |

*COURSE DESCRIPTION:* With respect to CMP processes F, G, I, K, L, M, O, P, Q, R, S, T, U, this course will enable the student to do the following:

1. When shown an actual process unit or given a description of one, describe the normal operation procedure to follow, including the frequencies involved, the conditions to look for, the actions to take, and for certain aspects, the operational "whys" that are most relevant.
2. When shown indications of abnormal situations, or given an appropriate description of them, recognize them as such and describe probable cause(s).
3. When shown a process unit, or given a description of one, describe references and tools available and use them to describe preventive maintenance procedures to follow, including the frequencies involved, the conditions to look for, and actions to take, and for certain aspects, the operational "whys" that are most relevant.
4. When shown actual indications of mechanical malfunctions or given a description of them, recognize them as such, describe the references and tools available for use in correcting the malfunction.
5. When given a specific procedure drawn from those covered in this course, describe those aspects of the procedure related directly to employee safety, including how they protect the employee.
6. Given the common name of a process unit or unit component designated OTHER in the CMP, name the CMP PRINCIPAL process unit or unit component to which the OTHER term relates.

*COURSE CODE:* 3-LC-I *QUARTER:* Third

*COURSE NAME:* LABORATORY CONTROL I

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* 2-BC; 1-BB

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 7 | 4 | 9 | 6 | 0 |

*COURSE DESCRIPTION:* With respect to laboratory analyses of settleable matter, volatile solids, suspended solids, pH, dissolved oxygen demand, chlorine, coliform, temperature, this course will enable the student to do the following:

1. When required by circumstances to conduct one of the indicated analyses, describe references and equipment needed and conduct analysis.
2. When asked about a specific procedure drawn from those covered in this course, describe and/or demonstrate those aspects of the procedure directly related to employee safety, including how they protect the employee.

*COURSE CODE:* 4-IPP *QUARTER:* Fourth

*COURSE NAME:* IN-PLANT PRACTICUM

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* 3-LC-I; 3-PO-II; 2-PO-I

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 16 | 4 | 0 | 8 | 36 |

*COURSE DESCRIPTION:* With respect to all CMP processes, the student will demonstrate his ability to do the following:

1. When shown an actual process unit, actually perform all those aspects of normal operating procedures treated in previous courses.
2. When shown actual indications of abnormal conditions, recognize as such and describe the probable cause(s).
3. When shown an actual process unit, select references and tools available for use (or prepare if not available) and use them to perform all those aspects of preventive maintenance procedures treated in previous courses.
4. When confronted with actual indications of mechanical malfunctions, recognize them as such, select necessary references and tools, use them to describe the immediate and/or long term operational adjustments that may be necessary, and identify the most probable cause(s) of the malfunction.
5. When circumstances require one of the analyses treated in previous courses, or when such an analysis is requested, select references and equipment available, and use them to conduct the related sampling and analysis.
6. When shown a process unit, demonstrate those aspects that relate directly to employee safety for all procedures treated in the previous courses.
7. When shown a process unit or a unit component that is designated OTHER in the CMP, name the CMP PRINCIPAL unit or unit component to which the OTHER item relates.
8. When circumstances require, select references and tools and use them to prepare daily and monthly reports to reflect data pertaining to procedures treated in previous courses.

*COURSE CODE:* 5-PO-III *QUARTER:* Fifth

*COURSE NAME:* PLANT OPERATIONS III

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* 4-IPP

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 6 | 3 | 6 | 6 | 3 |

*COURSE DESCRIPTION:* With respect to all CMP processes, this course will enable the student to do the following:

1. When confronted with actual indications of mechanical malfunction, recognize it as such, and with selected references and tools, describe the long term operational adjustments that may be necessary, and identify by name the most probable component(s) needing repair. If there is more than one probable cause, list in order of probability, briefly describe the nature of repair(s) and actually perform the repair(s).
2. When asked about a specific procedure drawn from those covered in this course, describe those aspects of the procedure directly related to employee safety, including how to protect the employee.
3. When given the common name or description of a significant process unit component, point to or otherwise locate the component on the process unit, describe references and tools available for use, and describe when the component is operative, what it does, and how and why it functions as it does.

*COURSE CODE:* 5-LC-II *QUARTER:* Fifth

*COURSE NAME:* LABORATORY CONTROL II

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* 3-LC-I

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 7 | 3 | 12 | 4 | 0 |

*COURSE DESCRIPTION:* With respect to laboratory analyses necessary for plant operation but not covered in previous courses, this course will enable the student to do the following:

1. When required by circumstances to conduct one of the indicated analyses, describe references and equipment needed and conduct the analysis.
2. When asked about a specific procedure drawn from those covered in this course, describe and/or demonstrate those aspects of the procedure directly related to employee safety, including how they protect the employee.

*COURSE CODE:* 5-PO-IV *QUARTER:* Fifth

*COURSE NAME:* PLANT OPERATIONS IV

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* 4-IPP

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 4 | 3 | 3 | 6 | 0 |

*COURSE DESCRIPTION:* With respect to all CMP processes, this course will enable the student to do the following:

1. When confronted with actual indications of abnormal conditions or given a description of them, recognize them as such and identify probable cause(s), describe the references and tools that are needed, and describe immediate and/or long term corrective measures required.
2. When a specific procedure drawn from those covered in this course is indicated, describe those aspects of the procedure directly related to employee safety, including how they protect the employee.

*COURSE CODE:* 6-PAR *QUARTER:* Sixth

*COURSE NAME:* PURCHASING AND REPORTING

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* All courses

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 3 | 2 | 3 | 6 | 0 |

*COURSE DESCRIPTION:* With respect to plants composed of CMP processes, this course will enable the student to do the following:

1. When given the name or description of a process unit or unit component, obtain the references and information needed and prepare purchase or service order(s).
2. When asked, obtain the necessary references and data and prepare a list of consumable supplies needed for a one-year period.
3. When asked, obtain the necessary references and data and prepare daily and monthly reports.
4. When asked, obtain the necessary references and data and prepare an annual operation/maintenance report.
5. When asked, obtain the necessary references and data and prepare an annual operation/maintenance budget breakdown for the coming year.

*COURSE CODE:* 6-PI *QUARTER:* Sixth

*COURSE NAME:* PROCESS INTERACTION

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* All technical courses

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 4 | 3 | 3 | 6 | 0 |

*COURSE DESCRIPTION:* With respect to plants composed of CMP processes, this course will enable the student to do the following:

1. When shown actual conditions or given a description of wastewater entering or of wastestream within a plant, name or describe the process unit(s) directly involved, and describe how the unit(s) deal with the conditions.
2. When shown a sample of a common waste or an appropriate facsimile, describe the types of data needed, the references and equipment needed, and use them to acquire specific data, describe possible effect(s) of the waste, if present in the plant's influent, on the plant's treatment process, and on the receiving stream.
3. When shown a process unit or given a description of the same, describe comprehensively the purpose of the unit within a treatment plant and how its function relates to other units.
4. When required to make preliminary proposals regarding the wastewater treatment needs of a specific community area, describe the types of data needed, the references and other information required, and use them to gather the data, to name the most probable processes needed in a treatment plant to meet the needs, and prepare a simple line diagram showing the contiguous relationship of the named processes.

*COURSE CODE:* 6-LC-III *QUARTER:* Sixth

*COURSE NAME:* LABORATORY CONTROL III

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* 5-LC-II

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 6 | 3 | 9 | 4 | 0 |

*COURSE DESCRIPTION:* With respect to a comprehensive sampling of plants composed of CMP processes, this course will enable the student to do the following:

1. When asked, obtain the necessary references and equipment and use them to describe the standard laboratory analyses and the frequency needed to determine the operational efficiency of specific units or combinations of units.
2. When asked to determine if a specific plant meets standard requirements and specifications related to the quality of wastestream and receiving water and given the results of appropriate laboratory analyses, obtain the necessary references and use them to determine if the results fall within an acceptable range of values.
3. When asked to plan the laboratory control procedures for a specific plant, obtain the references and equipment needed and use them to specify appropriate sampling locations and to describe the significance of each sampling location to the plant as a whole.

*COURSE CODE:* 7-PP *QUARTER:* Seventh

*COURSE NAME:* PERSONNEL PRACTICES, PUBLIC RELATIONS, AND PLANNING

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* All technical courses

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 3 | 2 | 3 | 6 | 0 |

*COURSE DESCRIPTION:* With respect to plants composed of CMP processes, the course will enable the student to do the following:

1. When asked, describe the types of information to use when interviewing an applicant for a job and describe how the information is relevant.
2. When asked, describe the types of information to use when conducting a new employee orientation and describe how the information is relevant.
3. Given an actual or simulated situation of justifiable cause for nonterminal discipline of an employee, identify it as such, describe why the cause justifies discipline, and describe the action(s) relating to the actual discipline procedure.
4. Given an actual or a simulated situation of a justifiable cause for employee dismissal, identify it as such, describe why the cause justifies dismissal and describe the action(s) related to the actual dismissal procedure.
5. Given an actual or a simulated situation where there is an expressed need for accomplishing employee personal or professional growth, identify it as such, describe the data and information available, and use them to locate specific resource(s) relating to the fulfillment of the expressed need.
6. When asked to prepare a list of the number and types of employees needed to operate a specific plant, describe the types of data and references needed, prepare the list, and justify the need for each employee.
7. Given an actual or simulated situation in which an employee merits recognition for his work, identify it as such, and plan and carry out a method for recognizing and publicizing the situation.
8. When asked, obtain the necessary data and references and prepare an outline for a presentation describing the operation of a specific plant to a group of lay persons.
9. Given an actual or simulated complaint from private citizens or public officials regarding conditions both relevant and irrelevant to the operation of a wastewater plant, identify them as relevant or irrelevant, describe how each complaint is relevant or irrelevant, and demonstrate an actual response to the complaints.
10. When asked, assemble the data and references needed to formulate statements supporting the appropriation of funds for needed plant expansion, and prepare relevant press releases and speeches.
11. When confronted with an actual or simulated "major" plant disaster, either possible, pending or in progress, identify it as such, describe the probable operational disruptions, plant dangers, and threats to health, obtain the necessary references and tools and use them to describe the immediate and/or long term preventive and/or corrective measures required.
12. Given the name of a process unit or component designated OTHER in the CMP, name the PRINCIPAL CMP process unit or component to which the OTHER unit or component relates, obtain the necessary references and data, and describe how the units or unit components are similar and/or different functionally and mechanically.
13. Given an opportunity to study the operation of a plant, obtain the necessary references and data, describe what, if any, changes are needed in day to day plant operations, explain why the changes are necessary and how they should be implemented.
14. Given an opportunity to study the operation of a plant, obtain the necessary references and data and describe what, if any, capital improvements are needed, why the improvements are necessary, and how much the cost will be.

*COURSE CODE:* 7-AWT *QUARTER:* Seventh

*COURSE NAME:* ADVANCED WASTE TREATMENT

*PREREQUISITE COURSES MOST DIRECTLY RELATED:* 6-PI

*RECOMMENDED HOURS OF INSTRUCTION PER WEEK*

| Credit Hours | In Classroom | In Lab | Self Study | In Plant |
|---|---|---|---|---|
| 8 | 5 | 3 | 12 | 9 |

*COURSE DESCRIPTION:* This course will enable the trainee to do the following with respect to water and advanced waste treatment unit processes:

1. When confronted with an actual, or appropriate facsimile, process, describe the normal range of removal of residuals, including organic matter, suspended solids, nutrients, trace metals, bacteria, and viruses.
2. When given the name or other description of a particular drinking water source, describe in terms understandable to the lay public the characteristics of water source that have a detrimental effect on the water distribution system.
3. When questioned, describe in terms understandable to the lay public the need for advanced waste-water treatment and the relationship between it and the treatment of raw water for drinking purposes.
4. When questioned, name the most common processes that may be found in water treatment plants and describe in terms understandable to the lay public the function of each process.
5. When presented with an actual advanced waste treatment process unit, or appropriate facsimile, identify the principal operational characteristics, including preventive and routine maintenance requirements.
6. When presented with an actual water treatment process unit or appropriate facsimile, identify the principal operational characteristics.

# APPENDIX

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## GLOSSARY

*Abnormal Operating Procedures*. Those activities of the plant employee that result from unusual and undesirable conditions of the wastestream. Abnormal operating procedures assist the plant employee to recognize that the wastestream is abnormal and to return it to an acceptable, normal condition.

*Behavior*. Any observable action of an individual.

*Behavioral Task Analysis*. The process of determining and documenting the behavioral components of a job or task by observing, analyzing, and describing the performance of the person(s) involved.

*Behavioral Objectives*. The specification of behaviors or performance of an individual. (Who does what, when, and how well.)

*Component (of the Equipment)*. A distinctive part of a *process unit*. The reciprocating pump on certain primary sedimentation process units is a component, and the impeller on that pump is also referred to as a component.

*Composite Model Plant (CMP)*. An imaginary representation of a wastewater treatment plant. The plant is a composite plant in the sense that is represents *many* different plants in one model. Processes may be duplicated; redundancy in the design of the model is planned to provide competency in the operation of any plant currently in operation. The CMP provides a concrete point of reference in deciding what specific skill and knowledge a student should acquire in order to reach the level of mastery required.

A letter of the alphabet identifies each process represented in the Composite Model Plant (CMP). Each process is further defined by the specific units of equipment that are related to the accomplishment of the indicated process. A more detailed discussion of the CMP may be found in the section on WASTEWATER TREATMENT FACILITIES in the text of this document.

*Corrective Maintenance Procedures*. Those maintenance activities of the plant employee that usually result from the breakdown and/or malfunction of a unit of equipment or one of its components.

*Criterion*. A standard for judging a goal.

*Criterion Behavior Categories*. Seven groupings within which thirty-seven individual general criterion behaviors are organized. The categories are not necessarily intended to represent the apparent grouping of behaviors in the actual operation of the plant; rather, the categories represent groupings of similar, related behaviors for each in analysis and for brevity in documentation. The names of the categories are: (1) Normal Operation Procedures, (2) Abnormal Operation Procedures, (3) Preventive Maintenance Procedures, (4) Corrective Maintenance Procedures, (5) Laboratory Control Procedures, (6) System Interaction Procedures, and (7) Management/Supervisory Procedures.

*In-Plant Instruction*. Used to indicate a continuation of formal learning as a student moves from the classroom/lab context into an actual, functioning facility. A high degree of structure is implied; detailed lesson plans should be employed with specific performance objectives and practical testing procedures. Capable instructor-operators should be assigned to coordinate and supervise in-plant instruction as a primary part of their duties. Learning is of primary importance in an in-plant instruction program--productive employment is a secondary factor.

*Laboratory Control Procedures*. The special and routine activities of the plant employee relating to laboratory analyses, the specification of sampling procedures and locations, and the general management of the laboratory facilities.

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*Reference*. An information source about a device or a process that is used concurrently with, or as a part of, the performance of some task. References may be in many forms: on separate pieces of cardstock, on pages in a book, on film for projection, on audio tape, or on an engraved plate attached to a piece of equipment.

*Student Entry Level*. The category of relevant knowledge and skill that a student has before entering a course. This prior experience and knowledge can be excluded from explicit treatment in the student's course of study.

*Systems Interaction Procedures*. Those activities of the plant employee concerned with relating the functioning of specific units or equipment to other process units and the system as a whole and relating the plant to the community which it serves.

*Unit*. A specific piece of equipment, or a combination of pieces, that serves to accomplish one of the standard wastewater treatment plant processes represented in the Composite Model Plant (CMP).

*Wastestream*. The influent or effluent from any process unit of a wastewater treatment plant. This includes liquids as well as solids; for example, raw wastewater, treated effluent, screenings, grit, recycled flow from the secondary clarifier, digester sludge, vacuum filter sludge, or drying bed sludge. (Compare with *wastewater* within the collection system the two terms are synonymous; once within the treatment plant proper, only the term wastestream is appropriate.)

*Wastewater*. The used water of a community, including the domestic, commercial, and industrial liquid wastes, and the ground, surface, and storm water. (Compare with *wastestream* above.)

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